DOCUMENT RESUME

ED 179 284 PS 011 014

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TITLE Mastery Motivation and Intellectual Development From 1 to 3 1/2 Years.
PUB DATE Sep 79
NOTE 12p.; Paper presented at the Annual Meeting of the American Psychological Association (87th, New York, NY, September 1-5, 1979)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Age Differences; Cognitive Development; *Infants; *Intellectual Development; Longitudinal Studies; *Mastery Learning; *Motivation; *Preschool Children; *Sex Differences

ABSTRACT

This study examines the longitudinal relationships between mastery motivation and differentiated measures cf intellectual development assessed at 1 and 3 1/2 years of age in a sample of 35 children (21 boys and 14 girls). At one year three types of mastery motivation were assessed using structured tasks: (1) producing effects (engaging in behaviors that produced immediate perceptual feedback), (2) practicing emerging skills (putting blocks in a bottle), and (3) problem-solving (getting a toy from behind a transparent barrier). The mastery score was the percentage of time the infant engaged in task directed behaviors. The infant's intellectual functioning at one year was assessed by the Bayley scales of infant development. Four components were derived from the Bayley items: problem-solving, practicing spatial relation skills, perceptual discrimination, and language. At 3 1/2 years of age a similar approach was taken in that both overall and component measures of mastery motivation and intellectual functioning were obtained. However, because of the many developmental changes over this time span parallel measures were not possible. Therefore, the mastery motivation was assessed by using two measures: persistence at solving difficult problems, and curiosity motivation. The intellectual functioning at this age was assessed by the McCarthy Scales of Children's Abilities. Results showed that the pattern of correlations differed considerably for boys and girls: for boys significant longitudinal correlations were found mainly for later mastery motivation, while for girls correlations were found only with later intellectual functioning. These findings indicate moderate continuity from infancy to early childhood. The theoretically important link between early mastery motivation and later intellectual development was found only for girls. (Author/MP)

Mastery Motivation and Intellectual Development From 1 to 3½ Years[1]

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[1] Paper presented at the annual meeting of American Psychological Association, New York, NY, September 1979.

Mastery Motivation and Intellectual Development From 1 to 3½ Years

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White, Hunt and others have postulated an intrinsic motivation to master the environment. We examined the longitudinal relationships between mastery motivation and differentiated measures of intellectual development assessed at 1 and 3½ years of age in a sample of 35 children.

At 1 year three types of mastery motivation were assessed using structured tasks. Intellectual development at 1 year was assessed with the Bayley Scales of Infant Development; four clusters were derived. At 3½ years aspects of mastery motivation appropriate to this age group were assessed and the McCarthy Scales of Children's Abilities was administered

The pattern of correlations differed considerably for boys and girls; therefore, the results will be reported separately for each sex. For boys significant longitudinal correlations were found mainly for later mastery motivation; for girls, on the other hand, relationships were found only with later intellectual functioning. That is, for boys 3½ year mastery behaviors were predicted by 1 year measures; whereas for girls, their intellectual abilities were predicted by their 1 year measures.

These findings indicate moderate continuity from infancy to early childhood. The theoretically important link between early mastery motivation and later intellectual development was found mainly for girls.

Mastery Motivation and Intellectual Development From 1 to 3½ Years

White (1959), Hunt (1965) and others have postulated an intrinsic motivation to master the environment. This motivation is a central force in intellectual development. As infants attempt to master their environment, they explore the properties of objects and thus develop increasingly differentiated concepts of the world. Little research has focused on this theoretically important area of motivation.

In contrast, considerable research effort has been directed at determining continuity between infant and preschool intellectual measures. These empirical efforts have met with comparatively little success. If mastery motivation is indeed central to early intellectual development, a continuity between infant motivation and later intellect may be present despite the lack of continuity in IQ. The current study examines continuity of motivation and intellectual functioning.

Method

At one year of age, a group of infants had participated in an extensive study of mastery motivation in our laboratory at NICHD. (See Yarrow, Morgan, Jennings, Harmon, and Gaiter, 1979.) This study had been carried out by Leon Yarrow, George Morgan, Bob Harmon, Juarlyn Gaiter, and myself. In the present study, we again assessed mastery motivation and intelligence in the children when they reached 3½ years of age. Thirty-five children from the original sample of 44 participated in this followup study. Amont the variables included in this report, no significant differences were found between those children that continued in the study and those that did not; however, significantly more boys were available for the followup study. There were 21 boys and

14 girls; they were from middle-class backgrounds and all but one were white. Assessments of mastery motivation and intellectual functioning were made at each age.

Mastery motivation at one year had been assessed by a series of structured tasks. Three types of mastery motivation had been differentiated and appropriate tasks had been developed for each type. These types were: a) producing effects, i.e., engaging in behaviors that produced immediate perceptual feedback, such as pulling the levers on a "busy box" type of toy; b) practicing emerging skills, e.g., putting blocks in a bottle; and c) problem-solving, e.g., getting a toy from behind a transparent barrier. The mastery score was the percentage of time the infant engaged in task directed behaviors. A separate mastery score was derived for each type of task and these were summed to form an overall mastery motivation score.

Intellectual functioning at 1 year was assessed by the Bayley scales of infant development; they were administered by a different tester in a separate session. In addition to the overall Mental Development Index, or MDI, four component scores were derived from the Bayley items. These were problem solving, practicing spatial relation skills, perceptual discrimination and language.

The methods and findings of the study at 1 year of age are discussed more fully in Morgan et al. (1977), and Yarrow et al. (1979).

At 3½ years of age a similar approach was taken in that both overall and component measures of mastery motivation and intellectual functioning were obtained. Of course, because of the many developmental changes over this time span, parallel measures were not possible. Building on the work of other investigators, we developed measures of several aspects of mastery motivation, but only two of these showed any evidence of concurrent validity. One measure was

persistence at solving difficult problems (Yarrow, Klein, Lomonaco and Morgan, 1975; Charlesworth, 1973) for example, solving a very difficult puzzle-type task. The second measure was curiosity motivation which was assessed by the amount of time spent manipulating a variety of objects attached to a "curiosity box" (Banta, 1970; Star, 1969).

Intellectual abilities at 3½ were assessed by the McCarthy Scales of Children's Abilities which were administered at a separate session by a different tester. The McCarthy provides a General Cognitive Index as well as several subscales (verbal, perceptual performance and quantitative).

Ideally, the followup assessment of the children would have been done by testers with no previous contact with them. We were largely able to meet this ideal with regard to intellectual functioning: 28 of the 35 children were assessed by a tester with no previous contact with them. On the other hand, 3½ year mastery motivation was assessed by someone who had tested the children at 1 year. Within each age, the mastery and intellectual measures were independently assessed by different testers. Comparison of the longitudinal correlations for the two testers showed that familiarity with the children had no apparent effect. (Such a comparison was possible only for correlations with the 3½ year intelligence measures.) The correlations were quite similar and there was no tendency for the tester who was familiar with the children to have generally higher correlations.

Results

The pattern of correlations differed considerably for boys and girls; therefore, the results will be reported separately for each sex. Table 1 presents these correlations. For boys significant longitudinal correlations were found mainly for later mastery motivation; for girls, on the other hand,

relationships were found only with later intellectual functioning. That is, for boys 3½ year mastery behaviors were predicted by 1 year measures; whereas for girls, their later intellectual abilities were predicted by their 1 year measures.

The specific relationships found will be discussed first for boys and then for girls. Beginning with relationships to 3½ year mastery motivation, boys who persisted at difficult tasks at 3½ years were found to have persisted longer at 1 year at tasks that produced effects ($r=.44$). These boys had also received higher scores on the Bayley Mental Development Index (MDI) ($r=.51$), and in particular they had done well on the perceptual discrimination items ($r=.51$). Boys who were more curious at 3½ had also persisted more at tasks that produced effects at 1 year ($r=.52$).

Turning to intellectual functioning at 3½ years, high scoring boys on the McCarthy General Cognitive Index had done well on the Bayley language component at 1 year ($r=.45$). No other relationships between the 3½ year McCarthy scores and the 1 year Bayley scores were significant. It is interesting to note that the Bayley language component correlated approximately equally (but not significantly) with all three subscales of the McCarthy; that is, early language ability in boys related to all aspects of later IQ; a specific relationship to later verbal intelligence was not found. Thus for boys significant longitudinal correlations were found mainly for 3½ year mastery motivation.

The pattern of correlations for the girls was quite different in that significant longitudinal correlations were found only for the 3½ year intelligence scores. High scoring girls on the McCarthy General Cognitive Index had earlier persisted longer on tasks that involved practicing emerging skills ($r=.58$); these girls had also performed well on the Bayley items assessing

perceptual discrimination (r=.60). In addition, the relationship between the McCarthy General Cognitive Index and the overall one-year mastery motivation score approached significance (r=.47, p .10).

Correlations with the McCarthy subscores indicated it was the perceptual performance items, rather than the verbal items, that accounted for the relationship in girls between the 3½ year McCarthy General Cognitive Index and the 1 year measures. Girls with high scores on the perceptual cognitive tasks at 3½ had shown greater overall persistence at 1 year as well as greater persistence on the specific tasks of producing effects and practicing emerging skills. Furthermore, these girls with high scores on the perceptual cognitive tasks at 3½ years had earlier performed well on the Bayley, particularly on the perceptual discrimination items.

Discussion

These findings indicate moderate continuity from infancy to early childhood. The theoretically important link between early mastery motivation and later intellectual development was found only for girls.

The present findings show some agreement with the literature. First, mastery behaviors (often termed task-oriented behaviors) have generally been found to be more stable for boys than for girls (Hunt and Eichorn, 1972; Dolan et al., 1974). Secondly, girls intelligence has generally been found to show more relationship than boys to their earlier intellectual functioning and mastery behavior (McCall, Hogarty, and Hurlburt, 1972).

The results of this study are not consistent with the literature in one respect. In the present study, early verbal skill was found to be somewhat more predictive of later verbal skills for boys; several previous studies have found such consistency only for girls (see McCall, Eichorn, and Hogarty, 1977).

One finding of the present study does not seem to have been examined previously. That is, girls nonverbal abilities (perceptual cognitive) were predicted by early mastery behaviors and by early intellectual abilities. Furthermore early abilities in this area for girls predicted later general intelligence. This finding warrants further study.

In closing, our understanding of early intellectual development is gradually expanding as more longitudinal studies of differentiated abilities become available. A prevalent view of a few years ago was that there was no continuity between infant and later intellectual functioning; however,.when the focus of interest is broadened to include mastery motivation behaviors, some continuity in development is found.

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Table 1

Correlations Between 1-Year Measures and 3½-Year Measures for Boys and for Girls

	1-Year Measures: Mastery: Overall score	Prod. effs.	Pract. skills	Prob. solv.	Cognitive: Bayley MDI	Prob. solv.	Percep. discr.	Language	Pract. skills	3½-Year Measures: Mastery: Persis. tasks	Curiosity	Cognitive: McCarthy Index	Verbal	Perc. cog.	Quantitative
1 Year Measures															
Mastery															
Overall score	--	.95*	.78*	.79*	.68*	.42	.57*	.65*	.50	.20	-.11	.47	.39	.60*	-.14
Producing effects	.77*	--	.66*	.60*	.55*	.49	.48	.62*	.36	.29	.06	.44	.41	.54*	-.13
Practic. em. skills	.42	.06	--	.48	.83*	.39	.71*	.55*	.73*	.28	-.12	.58*	.40	.69*	.06
Problem solving	.66*	.26	-.05	--	.52	.18	.39	[illegible]	.38	-.13	-.39	.23	.11	.38	-.05
Cognitive															
Bayley MDI	.68*	.43*	.73*	.19	--	.58*	.86*	.48	.85*	.02	-.40	.44	.15	.61*	.25
Problem solving	.41	.44*	.29	.08	.57*	--	.57*	.03	.34	-.00	-.10	.39	.35	.43	-.32
Percep. discrim.	.61*	.45*	.75*	.03	.87*	.59*	--	.30	.61*	.11	-.20	.60*	.41	.72*	.00
Language	.40	.40	.02	.33	.28	.25	.09	--	.23	.53	.03	.40	.29	.33	.00
Practic. spatial rel. skills	.33	.01	.56*	.11	.65*	.03	.49*	-.09	--	-.20	-.52	.26	-.02	.50	-.24
3½-Year Measures															
Mastery															
Persis. diffic. tasks	.23	.44*	.27	-.13	.54*	.25	.51*	.25	.25	--	.46	.40	.50	.20	.27
Curiosity	.12	.52*	-.12	-.27	.06	.15	.02	.29	-.29	.28	--	.37	.41	.29	.62*
Cognitive															
McCarthy Gen. Cognitive Index	.23	.27	-.03	.14	.04	.08	.12	.45*	-.02	.10	.18	--	.85*	.89*	.59*
Verbal	.25	.23	.02	.19	.07	.16	.12	.39	.04	.04	.20	.93*	--	.62*	.55*
Perceptual cog.	.14	.14	-.11	.13	.01	-.13	.08	.35	.13	.15	-.12	.75*	.49*	--	.42
Quantitative	.29	.39	.13	.05	.08	.05	.14	.32	.08	.34	.32	.71*	.60*	.53*	--

Note. Correlations for boys are below the diagonal and correlations for girls above the diagonal.